

PATENT COOPERATION TREATY

PCT

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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 19 MAR 2004

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Applicant's or agent's file reference	FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/PEA/416)	
International application No. PCT/GB 03/02835	International filing date (day/month/year) 02.07.2003	Priority date (day/month/year) 04.07.2002
International Patent Classification (IPC) or both national classification and IPC F16D3/26, F16D3/26		
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- This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
- This REPORT consists of a total of 6 sheets, including this cover sheet.

☒ This report is also accompanied by ANNEXES, i.e. sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

 These annexes consist of a total of 6 sheets.

- This report contains indications relating to the following items:

- | | | |
|------|-------------------------------------|--|
| I | <input checked="" type="checkbox"/> | Basis of the opinion |
| II | <input type="checkbox"/> | Priority |
| III | <input checked="" type="checkbox"/> | Non-establishment of opinion with regard to novelty, inventive step and industrial applicability |
| IV | <input type="checkbox"/> | Lack of unity of invention |
| V | <input checked="" type="checkbox"/> | Reasoned statement under Rule 66.2(a)(ii) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement |
| VI | <input type="checkbox"/> | Certain documents cited |
| VII | <input type="checkbox"/> | Certain defects in the international application |
| VIII | <input type="checkbox"/> | Certain observations on the international application |

Date of submission of the demand 16.01.2004	Date of completion of this report 18.03.2004
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Telephone No. +49 89 2399- 

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT**

International application No. **PCT/GB 03/02835**

I. Basis of the report

1. With regard to the **elements** of the international application (*Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17)*):

Description, Pages

1-26 as originally filed

Claims, Numbers

1-35 received on 16.01.2004 with letter of 15.01.2004

Drawings, Sheets

1/22-22/22 received on 01.10.2003

2. With regard to the **language**, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language: , which is:

- ☐ the language of a translation furnished for the purposes of the international search (under Rule 23.1(b)).
- ☐ the language of publication of the international application (under Rule 48.3(b)).
- ☐ the language of a translation furnished for the purposes of international preliminary examination (under Rule 55.2 and/or 55.3).

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

- ☐ contained in the international application in written form.
- ☐ filed together with the international application in computer readable form.
- ☐ furnished subsequently to this Authority in written form.
- ☐ furnished subsequently to this Authority in computer readable form.
- ☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.
- ☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. The amendments have resulted in the cancellation of:

- ☐ the description, pages:
- ☐ the claims, Nos.:
- ☐ the drawings, sheets:

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EXAMINATION REPORT**

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5. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed (Rule 70.2(c)).

(Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report.)

6. Additional observations, if necessary:

III. Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

1. The questions whether the claimed invention appears to be novel, to involve an inventive step (to be non-obvious), or to be industrially applicable have not been examined in respect of:

☐ the entire international application,

☒ claims Nos. 34,35

because:

☐ the said international application, or the said claims Nos. relate to the following subject matter which does not require an international preliminary examination (specify):

☒ the description, claims or drawings (*indicate particular elements below*) or said claims Nos. 34,35 are so unclear that no meaningful opinion could be formed (*specify*):

see separate sheet

☐ the claims, or said claims Nos. are so inadequately supported by the description that no meaningful opinion could be formed.

☐ no international search report has been established for the said claims Nos.

2. A meaningful international preliminary examination cannot be carried out due to the failure of the nucleotide and/or amino acid sequence listing to comply with the standard provided for in Annex C of the Administrative Instructions:

☐ the written form has not been furnished or does not comply with the Standard.

☐ the computer readable form has not been furnished or does not comply with the Standard.

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-32
	No: Claims	
Inventive step (IS)	Yes: Claims	1-32
	No: Claims	
Industrial applicability (IA)	Yes: Claims	1-32
	No: Claims	

2. Citations and explanations

**INTERNATIONAL PRELIMINARY
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see separate sheet

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB 03/02835

Reference is made to the following document:

D1: WO 00/46522 A (LICA CARDEN IPR LTD ; ATKINSON MARTIN ROBERT
(GB); CARDEN JOHN CRAVEN) 10 August 2000 (2000-08-10)

Re Item III

Non-establishment of opinion with regard to novelty, inventive step and industrial applicability

Claims 34 and 35 refer to the drawings and thus do not comply with Article 6 PCT in conjunction with Rule 6.2(a) PCT.

Re Item V

Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Claim 1

1.1 Closest Prior Art

The nearest prior art is considered to be D1 (cited in the description) which shows a constant velocity universal joint in accordance with the preamble of claim 1.

1.2 Problem To Be Solved

The problem to be solved may therefore be regarded as how to improve the dynamic balance of the joint.

1.3 Solution

The problem is solved by the eccentric cam profile of the claws which cooperates with the cage to produce reciprocation of the cage whilst ensuring that the hinge axis always lies on the bisecting angle plane between the two shaft axes. This has the effect of reducing the distance travelled by the reciprocating mass i.e. the cage thus improving the dynamic balance.

This solution is neither known from nor made obvious by the available prior art.

**INTERNATIONAL PRELIMINARY
EXAMINATION REPORT - SEPARATE SHEET**

International application No. PCT/GB 03/02835

2. Claims 2-33

Claims 2-33 concern further preferred embodiments of the invention.

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CLAIMS:

1. A constant velocity universal joint comprising two shafts, one shaft being the input and the other shaft being the output, each shaft having a claw located on one end, the claws being rotatably mounted on first and second hinge elements for rotation about an axis (V, V_1, V_2) which passes through the geometrical centre of the joint (G), and a cage which can reciprocate with respect to the hinge elements in the direction of the hinge axis (H), the cage containing the hinge elements and allowing them to oscillate relative to each other, the hinge axis (H) and the axis of each shaft intersecting at the geometrical centre (G) of the joint, characterised in that the claws have an eccentric cam profile which cooperates with the cage to produce the reciprocation of the cage with respect to the hinge elements whilst ensuring that the hinge axis (H) always lies on the bisecting angle plane between the two shaft axes.

2. A joint as claimed in Claim 1, wherein the claws and cage cooperate such that the claws rotate about the axis (V, V_1, V_2) by an equal and opposite amount relative to the hinge axis (H).

3. A joint as claimed in Claim 1, wherein centring control is provided by the cage which ensures that three degrees of freedom of motion in two planes are accommodated.

4. A joint as claimed in any preceding claim, wherein the cage performs two functions, the first being to hold the two hinge elements together to form the hinge and the second being to provide two face cams which react with the cam profile on the claws.

5. A joint as claimed in Claim 4 wherein the cage performs a third function in that it prevents any relative axial motion between the input and output shafts relative to the geometrical centre (G).

5 6. A joint as claimed in any preceding claim, wherein the eccentric cam profile of each claw cooperates with the cage to produce reciprocation of the cage with respect to the hinge elements when the claws are rotated about the axis (V, V₁, V₂).

10 7. A joint as claimed in any preceding claim, wherein the hinge elements each comprise a cross shaft with an integral stub axle which sits in a respective claw.

15 8. A joint as claimed in Claim 7, wherein each cross shaft is identical in form and has a part cylindrical groove and wherein a pair of centre bearings are seated between the grooves, the cross shafts thereby pivoting on the centre bearings about hinge axis (H).

20 9. A joint as claimed in Claim 8, wherein the centre bearings prevent any relative axial motion between the cross shafts.

25 10. A joint as claimed in Claim 7, wherein each cross shaft is identical in form having a part cylindrical recess at one end and an integral centre bearing at the other end, the cross shafts pivoting with respect to each other about the hinge axis (H).

11. A joint as claimed in any preceding claim, wherein the cage comprises two spaced containing rings fixedly connected to each other by projections

which form cross beams between the containing rings and which extend parallel to the hinge axis (H).

12. A joint as claimed in Claim 11, wherein the containing rings can be axially preloaded against the cam profiles to reduce backlash.

13. A joint as claimed in Claim 11, wherein the motion of the containing rings over the surfaces of the cross shafts takes the form of a cylindrical ellipse thus ensuring lubricant flow motion.

14. A joint as claimed in any preceding claim, further comprising a slipper element which sits between the cooperating surfaces of a claw and the cage to increase the surface area of contact.

15. A joint as claimed in Claim 14, wherein the slipper element can pivot about a point which passes through the centre of the cam profile of the claw.

16. A joint as claimed in Claim 14 or Claim 15, wherein a tongue is provided on each slipper element which cooperates with an arcuate slot in a cross shaft to prevent tilting of the slipper element.

17. A joint as claimed in any preceding claim, wherein each claw further comprises a preloading means to reduce backlash.

18. A joint as claimed in Claim 17, as dependent on any of Claims 14 to 16, wherein the preloading means is a preloading plate to which the slipper element is pivotally connected.

19 A joint as claimed in Claim 18, wherein the first and second hinge elements are fixedly secured to the preloading plate on a respective claw such that the claws can rotate about the axis (V, V_1, V_2) with respect to the hinge elements and preloading plates.

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20. A joint as claimed in Claim 14, wherein a centring mechanism is formed comprising the face cams on the cage, the slipper elements and the cam profile on each claw.

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21. A joint as claimed in Claim 20, wherein the centring mechanism enables a secondary force, produced as a result of the torque passing through the joint when articulated in the plane at right angles to the axes of the cross shafts, to pass over the sliding external surfaces of the joint.

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22. A joint as claimed in any of Claims 1 to 7, wherein the cage comprises two spaced containing rings fixedly connected to each other by a central cross beam which extends along and parallel to the hinge axis (H), the cross shafts pivoting with respect to each other about the central cross beam which also acts as the centre bearing.

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23. A joint as claimed in Claim 22, wherein each cross shaft is identical in form and has a part cylindrical centrally located recess in which a cylindrical ring lock sits, the ring lock being slidable on the central cross beam whilst locking together the cross shafts to prevent any relative axial motion between the cross shafts and being free to rotate relative to the cross shafts.

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24. A joint as claimed in Claim 22 or Claim 23, wherein each containing ring is screw threaded onto one end of the central cross beam.

25. A joint as claimed in any of Claims 22 to 24, further comprising a slipper element which sits between the cooperating surfaces of a claw and the cage to increase the surface area of contact.

5 26. A joint as claimed in Claim 25, wherein the slipper element pivots about a point which passes through the centre of the cam profile of the claw.

27. A joint as claimed in any of Claims 22 to 26, wherein each claw further comprises preloading means to reduce backlash.

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28. A joint as claimed in Claim 27, as dependent on Claim 7, wherein the preloading means are crossed roller bearings located between the stub axle and the inside surface of the claw.

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29. A joint as claimed in Claim 25 or Claim 26, wherein the containing rings are preloaded against the slipper elements and the slipper elements are preloaded against the cam profiles by means of the screw threads between the containing rings and the central cross beam.

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30. A joint as claimed in any of Claims 22 to 29, wherein the motion of the containing rings over the surfaces of the cross shafts takes the form of a cylindrical ellipse thus ensuring lubricant flow motion.

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31. A joint as claimed in any of Claims 22 to 30, wherein the motion of the cross shafts over the surface of the central cross beam takes the form of a cylindrical ellipse thus ensuring lubricant flow motion.

32. A joint as claimed in Claim 25, wherein a centring mechanism is formed comprising the face cams on the cage, the slipper elements and the cam profile on each claw.

5 33. A joint as claimed in Claim 32 wherein the centring mechanism enables a secondary force, produced as a result of the torque passing through the joint when articulated in a plane at right angles to the axes of the cross shafts, to pass over the sliding external surfaces of the joint.

10 34. A joint as shown in Figure 36 where there are plain bearings between the stub axles 210a and 210b and the claws 203 and 204, which are prevented from tilting relative to each other by the preloading of the containing rings 207 and 208 via the cross beam 240, said preloading being equal and opposite, passing through the outer and inner walls of the slippers 227 and 228 onto the cam
15 profiles of the claws 203 and 204.

35 A constant velocity joint substantially as herein described with reference to Figures 1 to 38.